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Article (Accepted Version)

Sovacool, Benjamin K, Kester, Johannes, Noel, Lance and Zarazua de Rubens, Gerardo (2019) Energy injustice and Nordic electric mobility: inequality, elitism, and externalities in the electrification of vehicle-to-grid (V2G) transport. Ecological Economics, 157. pp. 205-217. ISSN 0921-8009

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Energy injustice and Nordic electric mobility: Inequality, elitism, and externalities in the electrification of vehicle-to-grid (V2G) transport

1. Introduction

Questions of justice are becoming more central to ongoing debates within the environmental science, ecological economics, and energy policy communities. Matulis (2014) for instance argues that our attempts at valuing nature are just as much about ethics and justice as economics. Heindl and Kanschik (2016) suggest that justice needs to play a stronger role in guiding how society distributes ecological goods; Granqvist and Grover (2016) that we need to better integrate principles of fairness in the implementation of clean energy infrastructure. Chapman et al. (2018) state that social equity considerations can be just as impactful as economic issues such as the cost of energy services, or as salient as environmental priorities such as greenhouse gas reduction. Similarly, much of the discussion in the environmental studies community has emphasized “climate justice” (Bulkeley et al. 2013; Bulkeley et al. 2014) or “environmental justice” (Warlenius et al. 2016).

Writing more narrowly on the topic of low-carbon transitions, Mundaca et al. (2018) write that fairness and procedural justice must go “hand in hand” with energy shifts at the community level. Evensen et al. (2018) argue that efforts to influence household energy behavior, promote national security, or address fuel poverty all intersect with issues of energy justice. Healy et al. (2019) emphasize how an energy justice focus can promote improved governance and accountability of transitions, and also catalyze social movements and reforms. Ikeme (2003) also writes that without a focus on justice and equity issues, approaches to energy and climate policy, and even politics, remain incomplete.

However, despite the case for justice being so compellingly made, much of the research on transport, as well as personal electric mobility transitions, has been descriptive or positive. A growing stream of literature lauds benefits, assesses adoption rates, calculates co-benefits, or projects future pathways. Research has shown for instance that electric mobility can lead to more resilient cities (Comodi et al. 2016) or reduce negative externalities such as pollution (Noel et al. 2018). When connected to the grid, battery electric vehicles (EVs) can enhance the efficiency of distribution networks (Pirouzi et al. 2018), contribute positively to grid stabilization while also displacing fossil fuels such as natural gas (Nunes and Brito 2017), and act as decentralized modes of energy storage (Weiller and Neely 2014). Coupling EVs to electric power networks via vehicle-to-grid (V2G) can only enhance the scope and extent of these benefits, as V2G can facilitate storage of renewables, generate additional revenues for drivers, and enable better load management from electricity suppliers (Lund and Kempton 2008; Hidrue and Parsons 2015; Sovacool et al. 2017; Sovacool et al. 2018). V2G EVs can lastly become key components of 100% “smart” or “clean” renewable energy systems (Mathiesen et al. 2015; Mathiesen et al. 2011).

This body of evidence has generally *not* been normative or critical. It has not sought to consider the deeper ethical and moral issues that arise as electric mobility comes to substitute for conventional vehicles (Sovacool et al. 2018a; Jenkins et al. 2018). Likewise, Pereira et al. (2017) write that:

> *Over the past decades, transport researchers and policymakers have devoted increasing attention to questions about justice and equity. Nonetheless, there is still little engagement with theories in political philosophy to frame what justice means in the context of transport policies*.

Mullen and Marsden (2016) agree and note a dearth of justice centered approaches to examining low-carbon mobility, especially insofar as “mobility systems raise multiple questions of justice” and that research often lacks a full view of “winners and losers.” More recently, Banister (2018) suggests that transport scholars must adopt a winder interpretation of equality and inequality, one better linked to wellbeing and sustainability, in their research.

If so, we need better normative analyses to complement the more established and descriptive work on techno-economic dimensions.

To meet these calls to examine low-carbon mobility transitions from a critically normative or energy justice lens, this study assesses the ongoing electrification of passenger transport in the Nordic region. Because numerous studies (such as those above) have already focused on the benefits to electric mobility transitions, we instead ask: what are the types of injustices associated with electric mobility and vehicle-to-grid (V2G)? Relatedly, in what ways do emerging patterns of electric mobility worsen social risks or vulnerabilities? We answer these questions by first elaborating an “energy justice” framework consisting of four distinct dimensions—distributive (costs and benefits), procedural (due process), cosmopolitan (global externalities), and recognition (vulnerable groups). We then draw from original data collected from 227 semi-structured interviews with 257 expert participants from over 200 institutions across Denmark, Finland, Iceland, Norway, and Sweden to examine such justice implications. In this way, the study is “doubly normative” in terms of applying a normative conceptual framework (energy justice) and also drawing from normative claims made by our empirical material (interviewee respondents). Although complex, such a normative justice perspective can provide a means to unsettle or challenge the dominant positioning of EVs or mobility as neutral or amoral within the technical and economic literature.

When seeking to explicitly and qualitatively catalogue injustices, the study finds that EVs and V2G systems can violate tenets of distributive justice for being accessible only to the rich, and for raising risks related to privacy, hacking, and cyberterrorism. EV policies may contravene aspects of procedural justice by reinforcing exclusion and elitism in national transport and energy planning. EVs can potentially erode cosmopolitan justice (albeit at a lower level than conventional cars), as they still contribute to traffic congestion and health risks and producing their own set of negative externalities, some that worsen regional vulnerability or cross national borders. EVs and V2G can lastly threaten recognition justice through shifting job-creation to other business units (i.e. from maintenance to computer electronics), and creating loss of jobs and disruption to vulnerable groups and the entrenchment of patriarchy.

In proceeding as such, the article aims to make three contributions. First, and most pragmatically, little transport, mobility, or even justice literature has addressed the specific topic of V2G, a term referring to EVs having the opportunity to become self-contained resources that can help manage power flow and displace the need for electric utility infrastructure. As alluded to above, a transition to V2G could enable EVs to simultaneously improve the efficiency (and profitability) of electricity grids, reduce greenhouse gas emissions from transport, accommodate low-carbon sources of energy, and reap cost savings for vehicle owners, drivers, and other users. Yet their justice dimensions have not yet been systematically investigated, even qualitatively. Such a qualitative mapping can in particular reveal general relationships and hypotheses that could be further tested by quantitative analysis or economic modeling at a later stage (Berman and Kofinas 2004).

Second, and empirically, the critical lens of the study aims to force more justice aware research and policymaking related to EVs in the Nordic region (and beyond), so that vulnerabilities and risks can be mitigated, and losers minimized or compensated. The Nordic region has aggressive energy, transport and climate policies backed by welfare states with high taxes (Westholm and Lindahl 2012); high penetration rates for the adoption of renewable electricity and energy efficiency (International Energy Agency and Nordic Energy Research 2013, International Energy Agency and Nordic Energy Research 2016; Sovacool 2017); and (most relevant for this study) high rates of adoption for EVs (Berkeley et al. 2017). The International Energy Agency (2018) notes that across Denmark, Finland, Iceland, Norway, and Sweden, the total stock of EVs reached 250,000 cars at the end of 2017 and accounted for 8% of the global total, the third-largest share after China and the United States. The per capita diffusion of EVs across the Nordic region is *highest* in the world at 10.6%; the growth rate the highest in the world (up 57% from the previous year); and Norway features a 39% market share of electric cars sales. The article therefore attempts to "humanize" and illuminate the justice concerns surrounding this emergent yet ongoing Nordic transition to electric mobility.

Third, and methodologically, the bulk of literature on both energy justice and transport and mobility justice have been mostly conceptual. These studies often utilize data based on literature reviews or case studies. Here, we utilize original primary data through a diverse and rich collection of research interviews. In this way, we test or validate conceptual elements of justice with original expert evidence.

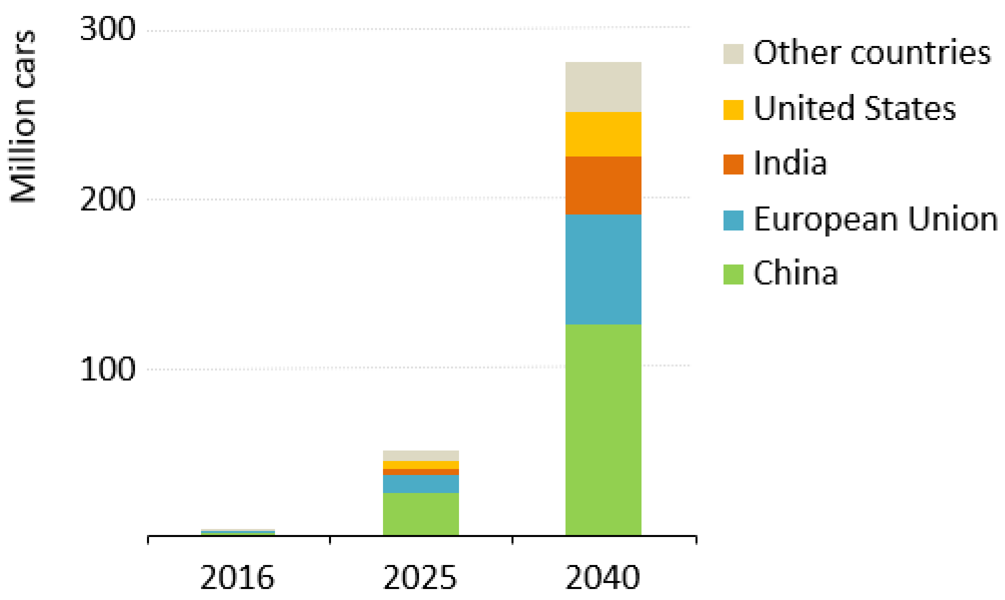
2. "Electric mobility" and "energy justice:" conceptual applications

To begin, it is useful to start with some basic terms and concepts. The most essential is that of "electric mobility," a term we deploy to include passenger EVs, V2G, and e-bikes. The electrification of passenger vehicles has the potential to considerably improve the efficiency, sustainability, affordability, and acceptability of modes of transport.

For instance, numerous studies in the literature suggest that EVs generally operate more efficiently than those that run on internal combustion engines, given the comparative efficiency of electric drivetrains (Sovacool and Hirsh 2009; Tran et al. 2012; Mitchell et al. 2010). The environmental and climate change benefits of EVs can vary considerably by context, but generally have positive greenhouse gas emissions reductions compared to conventional vehicles, ranging from 10-24% (Hawkins et al., 2013) to 62-65% (Addison et al. 2010). Other broader social co-benefits of EVs include displaced urban air pollution and improved public health; von Stackelberg et al. (2013) for instance calculated that gasoline passenger vehicles cause $26 billion in health damages annually in the United States.

Moreover, when combined with low-carbon forms of electricity supply or integrated with heat networks, many studies have found the co-benefits of EVs to multiply even further (Jacobson et al. 2013; Noel 2017; Noel et al. 2017; Noel et al. 2018). Lastly, when using V2G, EVs have the ability to provide large-scale storage to intermittent renewable electricity sources, enhancing their potential for climate change mitigation (Kempton and Tomic 2005; Budischak et al. 2013; Kester et al. 2018). Perhaps due to these profuse benefits, the International Energy Agency (2017) projected that at least 280 million electric vehicles will be adopted by 2040, as Figure 1 indicates.

Figure 1: Global Diffusion of Electric Vehicles, 2016 to 2040



Source: International Energy Agency 2017.

To analyze electric mobility in the Nordic region, this study relied on a holistic, normative and qualitative framework of "energy justice." As summarized by Sovacool et al. (2016), Sovacool et al. (2017), and McCauley et al. (2018), this framework can be typified as consisting of four interconnected and somewhat central tenets of modern justice theory: distributive justice, procedural justice, cosmopolitan justice, and justice as recognition. When applied to electric mobility, EVs, and V2G in particular, Table 1 demonstrates how this "energy justice" approach underscores issues as diverse as benefits and burdens (distributive justice), planning and policy (procedural justice), globally produced or distributed externalities (cosmopolitan justice), and impacts on vulnerable groups (recognition justice). The remainder of this section introduces each of these four justice dimensions, and then examines evidence linking them to energy and transport.

Table 1: Energy Justice Dimensions, Definitions, and Applications

Dimension	Definition	Application to electric mobility
Distributive justice	Equitable or utilitarian distribution of social and economic benefits and burdens within and across different generations	Benefits and burdens of vehicle use, equity of access
Procedural justice	Adherence to due process and fair treatment of individuals under the law	Planning, due process, and policy issues surrounding incentives and regulations
Cosmopolitan justice	Universal respect for individual human rights regardless of one's identity	Globally produced or distributed externalities including embodied emissions, pollution, and lifestyle impacts
Justice as recognition	Appreciation for the vulnerable, marginalized, poor, or otherwise under-represented or misrepresented populations and demographic groups	Impacts on vulnerable groups, especially women, children, minorities, or indigenous people

Source: Authors

2.1 Distributive justice

Theories of distributive justice date back to the Greeks and are prominently associated with the work of either utilitarian philosophers (emphasizing costs and benefits, pleasure and pain) (Sovacool and Dworkin 2014), or more modern theorists John Rawls (1971) Ronald Dworkin (1981a, 1981b). Such theories concern themselves with how social goods and evils are allocated among society. Generally, distributive justice deals intently with three aspects of distribution: What goods, such as wealth, power, respect, food, or clothing, are to be distributed? Between what entities are they to be distributed (e.g., living or future generations, members of a political community or all humankind)? And what is the proper mode of distribution— is it based on need, merit, utility, entitlement, property rights, or something else? As Table 2 indicates, such distributive justice issues can be spatial (international or intranational) as well as temporal (intergenerational).

Table 2: Distributive Justice Dimensions, Issues, and Examples

Dimension	**Issue**	**Energy justice example(s)**
International	Unequal development	Considers the disadvantages of poorer countries and poorer groups within those countries in the face of higher energy costs resulting from the enforced adoption of low-carbon options and the elimination of subsidies for conventional fuels. Also addresses the disadvantages faced by developing countries in ensuring just development and application of international climate change policy.
	Vulnerability to impacts of climate change	Addresses the uneven impacts arising from higher vulnerability to both sea-level rise and extreme weather events in poorer countries.
Intergenerational	Impacts on future generations	Includes both issues with availability of non-renewable resources in the future, and the direct impacts of climate change, both of which are unequal between current and future generations.
Intranational	Access to energy services	Address issues of energy poverty and uneven fuel security. Mainly distributional in approach but also includes some work applying capabilities and recognition.
	Access to capital	Primarily relating to obstacles in access to microgeneration and energy efficiency measures for poorer households.
	Skill levels	Considers skills as a critical factor in respect of whether communities or localities can access the potential benefits of energy system investments.
	Localised impacts or benefits	A very common framing, focusing on the uneven distribution of environmental impacts and economic benefits. Substantial literatures in respect of several different energy technologies.
	Worker risk	Addresses uneven health risks faced by workers, particularly in the nuclear industry and in mining.

Source: Modified from McLaren 2012.

Given that entire philosophical schools such as utilitarianism, social contract theory, and cost-benefit analysis are grounded in distributive justice, and also that economics as a whole has a strong element examining distribution and equity, the list of specific studies applying distributional justice principles to energy and mobility is interminable. Nonetheless, to cite just a few compelling linkages, in Australia middle and upper income households consumed as much as four times the amount of fuel, light, power, and transport services than lower income homes (Hoa 1985). Tindale and Hewett (1999) discovered a clear relationship between income and car ownership in the United Kingdom, with the richest decile eleven times more likely to have the use of a private car than households in the poorest decile, where less than one in ten own their own automobile. Jacobson and Kammen (2005) appraised the equity of energy use in El Salvador, Kenya, Norway, Thailand, and the United States. Even the most equitable country, Norway, saw half of residential electricity being used by only 38 percent of customers; in the United States half of household electricity was used by 25 percent of households; in El Salvador, 15 percent; Thailand, 13 percent; and Kenya, 6 percent. Druckman and Jackson (2008) looked at large disparities in the United Kingdom in the use of energy-intensive technologies like clothes washers, clothes driers, refrigerators, and freezers. Papathanasopoulou and Jackson (2008) examined fossil fuel consumption in the United Kingdom from 1968 to 2000, and found that higher incomes result in much greater consumption of fuel, car use, recreation, and international travel. Wells (2012: 751) noted that transport and mobility can reinforce patterns of exclusion, inequality, and poverty. Berry et al. (2016) found that rates of transport fuel poverty—unaffordable access to mobility—were significant in countries such as France, where it effected as much as 10% of the population. Huijts (2018) found that injustice in the form of distributive unfairness led to strong feelings of anger towards the citing of hydrogen infrastructure in the Netherlands.

2.2 Procedural justice

Procedural justice emphasizes an entirely different aspect of justice: principles of due process, representative justice, and justice as public participation (Sovacool and Dworkin 2014). Generally, these ideas center on who sets rules and laws, who is recognized in planning, and the impartiality and fairness of the decisions that result. Procedural theories of justice are thus all oriented with process (Weston 2008) or deliberative democracy (Gutmann 2004). In parallel, Paavola et al. (2006) argue that procedural justice deals with recognition (who is recognized), participation (who gets to participate), and power (how is power distributed in decision-making forums). Although procedural justice may strike some as dry and unimportant, fair procedures matter because they tend to promote better—more equitable but also more efficient and effective—outcomes (Dolan et al. 2007). Table 3 illustrates six common dimensiosn to procedural justice as well as four different international approaches.

Table 3: Procedural justice dimensions and approaches

Dimensions	**Approaches**			
	Legal and regulatory	**Århus Convention**	**International arbitration**	**Organisational**
Access to information	Transparency	Freedom of information	Adequate notice	Bilateral communication and familiarity
Participation	Voice, representation	Participation	Right to be heard	Refutability, bilateral communication
Impartiality	Impartial Unbiased Consistent		Right to composition of tribunal, Independence	Impartiality
Accessibility	Access to a fair hearing	Timely, affordable access to justice	Right of standing	Courtesy (and respect) Appeal rights
Objectivity	Objectivity Consistency	Merits based	Reasoned judgement	Explanation
Respect			Reasoned judgement	Courtesy

Source: Modified from McLaren 2012.

When explicitly applied to energy or transport topics, Haggett (2009) notes that there are pragmatic reasons for ensuring due process. For instance, public involvement can increase the likelihood of support, and therefore ultimate approval, for the siting of energy or transport projects. As she writes, “while fiscal regulations and subsidies, technical efficiency and political deliberations all affect the deployment of renewables, the stark fact remains that all of this matters little if there is no public support for a development” (Haggett 2009: 299). Walker and Baxter (2017) conclude that opposition to the development of local wind farms in

Candida was highly associated with a lack of procedural justice including few opportunities to take part in siting discussions. Evensen et al. (2018) argue that the social legitimacy or acceptance of different energy technologies or policies will be influenced by procedural justice aspects of whether consumers or citizens feel they have a “voice” in decision-making as well as whether procedural issues were treated with “respect, openness, and honesty.” Likewise, Ryder (2018) found issues of procedural justice an important factor in determining the social acceptability of oil and gas projects within communities.

2.3 Cosmopolitan justice

Cosmopolitan justice suggests that moral principles—such as those from distributive and procedural justice—must apply universally to all human beings in all nations. Cosmopolitan justice acknowledges that all ethnic groups belong to a single community based on a collective morality. Moellendorf (2002: 171) writes that cosmopolitanism implies that “duties of justice are global in scope, and these duties require adherence to general principles including respect for civil and democratic rights and substantial socioeconomic egalitarianism.” Put another way, as advanced across a variety of works (Pogge 1992; Caney 2005a; Brock 2009; Held 2010), cosmopolitan justice accepts that all human beings have equal moral worth and that our responsibilities to others do not stop at borders. It suggests that the ultimate unit of concerns are human beings and persons, not communities or nation-states. It argues that justice concerns apply to everyone equally, regardless of their gender or social status. It holds that the way to individual and communal mutual benefit is to treat others as they themselves would wish to be treated. Although it acknowledges we are influenced by cultures and a diversity of perspectives, it lastly states that one is a member of a global community of human beings.

When utilized as a part of energy justice theory, cosmopolitanism holds that ethical responsibilities apply everywhere and to all moral agents capable of understanding and acting on them, not only to members of one community or another (Sovacool et al. 2016). Caney (2005b: 756) applies cosmopolitan principles to argue that people have a “positive right” to a clean and safe environment, as well as the “human right not to suffer from the disadvantages generated by global climate change.” Similarly, Harris (2011) uses a cosmopolitan lens to argue that distance and geography makes no moral difference as to complicity in pollution flows: individual sources of pollution have a moral duty to reduce it. Walker (2012: 179) writes that cosmopolitan thinking demands a holistic, global appraisal about the spatiality (distribution across geographic space) and temporality (timing of impacts) of energy or climate related costs and externalities. Labelle (2017) suggests that cosmopolitan justice enables one to challenge government led attempts to narrowly reduce costs or bring stability to markets without considering negative social effects within or beyond national borders; and Heffron and McCauley (2017) argue a cosmopolitan perspective in the context of energy justice requires a whole systems approach that looks at lifecycle consequences across the globe.

2.4 Recognition justice

Sometimes also known as the injustice of misrecognition, recognition justice originates from Fraser (1998) and Fraser and Honneth (2003). Recognition justice advocates both for tolerance and that vulnerable individuals must be fairly represented, that they must be free from physical threats and that they must be offered complete and equal political rights. It suggests that justice as recognition manifests itself not only as a failure to recognize a class of energy users or stakeholders, but also as the practice of misrecognizing itself—a distortion of people’s views, status, class, or ethnicity that may appear demeaning or contemptible. From this perspective, recognition justice places more emphasis on comprehending differences and accommodating particular needs (Walker and Day 2012). Recognition justice scholarship challenges the predominantly accepted discourse of distribution and procedure, suggesting that vulnerable classes of people get special representation, treatment, or protection (Jenkins et al. 2016b). McCauley and Heffron (2018) frame it around a narrative of "restoration," to repair harm rather than to only punish an offender.

When applied to energy or transport, recognition justice demands that one explores which groups of potential users may become more vulnerable, or conversely, which classes of already existing vulnerable groups could see their vulnerability worsen. Tyfield et al. (2014) note that new transport innovations can be disempowering and alienating, and one must ask whether they are enabling or disabling for particular demographic or cultural groups. They also suggest that one must consider collective identity and quality of life and wellbeing among potentially impacted groups. Hurlbert and Rayner (2018) write that society has a duty to recognize that the interests of vulnerable groups or indigenous people, such as the Chippewas First Nation in Canada, may stand apart from general societal interests and deserve special status in justice considerations. Broto et al. (2018) demonstrate how a recognition justice approach unveils hidden disparities in how urban versus rural people in Mozambique experience access to electricity and modern energy services. Partridge et al. (2018) extoll the values of including recognition justice as a lens which evaluates shale gas extraction in the United States and United Kingdom.

3. Empirical strategy: Expert research interviews and qualitative analysis

To assess the interstitial injustice dimensions to electric mobility and V2G in the Nordic region, our primary source of data was 227 semi-structured interviews with 257 expert participants from over 200 institutions across each of the five Nordic countries. This data was collected as part of a larger project looking at various aspects of the sociotechnical transition to electric mobility and V2G in Denmark, Finland, Iceland, Norway and Sweden (Sovacool et al. 2018a; Sovacool et al. 2018b; Sovacool et al. 2018c; Kester et al. 2018a;

Kester et al. 2018b; Kester et al. 2019; Noel et al. 2018; Noel et al. 2019; Zarazua 2018). The choice for expert (or "elite") semi-structured interviews may seem odd, given the justice focus of the study, but it follows the complexity of the topic of electric mobility and V2G, allowing for longer and more complete discussion. Interview respondents were asked, among other questions, "What do you see as some of the most significant benefits, and barriers, facing electric mobility and V2G in the Nordic region?" The term "electric mobility" was meant to encompass passenger vehicles such as hybrids, plug-in hybrids, and full battery electric cars (hereafter called "EVs") but experts were free to discuss e-bikes and other electrified transport modes, like electrified heavy transport.

Those interviewed in Denmark, Finland, Iceland, Norway and Sweden were selected to represent the diverse array of stakeholders involved with electric mobility, from both a transport and an electricity side. In particular, we interviewed experts from:

- National government ministries, agencies, and departments including the Ministry of Industries & Innovation (Iceland), Ministry of Environment and Energy (Sweden), Ministry of Finance (Finland), and Ministry of Taxation (Denmark):
- Local government ministries, agencies, and departments including the Akureyri Municipality (Iceland), City of Stockholm (Sweden), Aarhus Kommune (Denmark), City of Tampere (Finland), City of Oslo (Norway), and Trondheim Kommune (Norway);
- Regulatory authorities and bodies including the National Energy Authority (Iceland), Danish Transport Authority, Icelandic Transport Authority, Helsinki Regional Transport Authority (Finland) and Trafi (Finland);
- Universities and research institutes including the University of Iceland, Swedish Environmental Institute, DTU (Denmark), Aalborg University (Denmark), VTT

Technical Research Centre (Finland), NTNU (Norway), and the Arctic University of Norway;

- Electricity industry players such as ON Energy (Iceland), E.ON (Sweden), Vattenfall (Sweden), Energinet (Denmark), DONG (Denmark), Fingrid (Finland), Elenia (Finland) and Statnett (Norway);
- Automobile manufacturers and dealerships including the BMW Group (Norway), Volvo (Sweden), Nissan Nordic (Finland), Volkswagen (Norway), and Renault (Denmark);
- Private sector companies including Siemens Mobility (Denmark), Nuvve (Denmark), Fortrum (Finland), Virta (Finland), Clever (Sweden), Nordpool, (Sweden), Norske Hydrogen (Norway), Microsoft (Norway) and Schneider Electric (Norway);
- Industry groups and civil society organizations such as Danske Elbil Alliance (Denmark), Finnish Petroleum and Biofuels Association, Tesla Club (Finland), Power Circle (Sweden) and the Norwegian Electric Vehicle Association.

Table 4 offers an overview of our interviews and respondents by country, gender, focus area, and sector.

Table 4: Overview of Research Interviews and Respondents

	Interviews (n=227)	**Respondents (n=257)**	**% of Respondents**
Country = Iceland (Sept-Oct 2016)	29	36	14.0%
Country = Sweden (Nov-Dec 2016)	42	44	17.1%
Country = Denmark (Jan-Mar 2017)	45	53	20.6%
Country = Finland (Mar 2017)	50	57	22.2%
Country = Norway (Apr-May 2017)	61	67	26.1%
Gender = Male	160	207	80.5%
Gender = Female	40	50	19.5%
Gender = Mixed groups	27		
Focus[a] = Transport or Logistics	73	81	31.5%
Focus = Energy or Electricity System	63	75	29.2%
Focus = Funding or Investment	10	12	4.7%
Focus = Environment or Climate Change	12	16	6.2%
Focus = Fuel Consumption and Technology	22	23	8.9%
Focus = Other	13	14	5.4%

Focus = EVs and Charging Technology	34	36	14.0%
Sector[b] = Commercial	66	70	27.2%
Sector = Public	37	46	17.9%
Sector = Semi-Public	40	51	19.8%
Sector = Research	37	39	15.2%
Sector = Non-Profit and Media	12	13	5.1%
Sector = Lobby	22	25	9.7%
Sector = Consultancy	10	10	3.9%

Source: Authors.
[a] Focus represents the primary focus area of the organization or person in question.
[b] Sector represents the sector the company was working in (semi-public referring to commercial companies owned by public authorities, like DSOs).

Participants were guaranteed anonymity and not prompted for responses. To encourage candor and protect respondents, we present such data as anonymous. We did not correct respondents or normalize and modify answers in anyway—meaning at times respondents are speaking to their perceptions, rather than absolute or definitive facts. On average, the interviews lasted between thirty and ninety minutes. As some interviews included multiple respondents, each participant was given a unique respondent number (e.g., R187). Each interview was recorded, fully transcribed, and then coded using NVIVO. We then conducted frequency counts of the coded transcripts to inductively distill common justice themes, which we elaborate on more in the next section. This enables the study to have an "inductive," "negotiated," or "grounded" element (Berman and Kofinas 2004; Tacconi 1998), in that our results are drawn entirely from ("grounded in") the interviewee material and the secondary literature suggested by interviewee respondents.

In terms of strengths, our research design enabled us to collect qualitative data in a conversational style of information-gathering, allowing space for spontaneous responses that added depth and in some instances unforeseen evidence or previously unknown arguments to our findings (Harrell and Bradley 2009). An additional advantage is that interviews enabled interactivity because they encouraged participants to talk openly, and also allowed the conversation to attain suitable momentum that prompted exploratory investigations of topics (George and Bennett 2004). Moreover, the visual element of the interviews enabled us to look for nonverbal cues to decide whether a respondent understood a question (King et al. 1994), meaning we could rephrase questions or prompt participants to elaborate on their answers. Furthermore, Yin (2003) argues that semi-structured research interviews are most appropriate when the objective of the research is to understand complex elements and their intersection with perceptions, beliefs, and norms—particularly the case with justice issues. Qualitative interviews are especially recommended when the research objective is to solicit stakeholder perceptions (Canova and Hickey 2012) or assess value-based or normative criteria (Loring and Hinzman 2018).

Nonetheless, our method does have some shortcomings. The qualitative aspect of interview responses makes them difficult to code and answers understandably varied for each participant. Some respondents may have provided socially desirable responses, telling us what they think we wanted to hear. Others could have deliberately given answers that they thought would sway the outcome of the study in their favor. Inaccuracies could also arise due to poor recall and memory of the interviewee (Kroes and Sheldon 1988). We have attempted to minimize these shortcomings by validating their findings with a secondary method, that of a literature review, and by triangulating responses within the sample (i.e., not presenting only minority opinions or flagging when a statement could not be confirmed) and by conducting frequency counts of responses below.

4. Results and discussion: Rethinking the injustice of electric mobility and V2G

Across the entire population of interviews, justice issues—even though they were only indirectly queried through the language of “benefits” and “barriers”—arose with perhaps surprising frequency. As Table 5 summarizes, respondents made 162 distinct statements that we coded as falling within distributive, procedural, cosmopolitan, or recognition injustice dimensions (for more details on the coding process, see the footnote to Table 5). The remainder of this section discusses each in turn, beginning with an explanation of the issues at stake, with references to previous research when relevant, followed by supporting interview statements.

Table 5: Overview of energy injustices related to electric mobility and V2G in the Nordic region

Dimension	Frequency by interview respondents (N=257)*	Frequency by statements (N=162)	Example(s)
Distributive justice	30%	48%	EVs are luxury goods, accessible only to the rich
			Infringements on privacy, hacking, and cyberterrorism
Procedural justice	17%	27%	Exclusion and elitism in national transport and energy planning behind EV policies and incentives
			Capture of consumers and authoritarian business models
Cosmopolitan justice	9%	14%	Contribution to congestion and health risks
			Externalities (air, climate, water) and lifestyle impacts
Recognition justice	7%	11%	Loss of jobs/disruption to traditional businesses
			Exacerbation of vulnerability (rural areas)
			Entrenchment of patriarchy

*Source: Authors. *Note: Coding the frequency of particular statements was admittedly difficult, given that they rely on a mix of different terms and phrases. We therefore adopted a grounded coding strategy that had us code, and then recode, based on common or recurring statements. We identified 78 statements about distributive justice by coding among all interviews for the words and phrases related to "equity," "equality," "cost," "price," "affordability," "access," "privacy," "terrorism," and "hacking." We identified 44 statements about procedural justice searching for terms such as "procedural," "due process," "fairness," "accountability," "transparency," "elite," "democracy," "participatory," "exclusion," "democratic" and "authoritarian." We identified 22 statements about cosmopolitan justice by searching for the terms "externality," "congestion," "traffic jam," "pollution," "water," "carbon," "climate," and "health." We identified 18 statements about recognition justice by searching for "disruption," "employment," "jobs," "vulnerability," "minorities," "rural," "gender," "sex," and "patriarchy." Statements were mutually exclusive—they were only placed in the single category for which they best fit.*

4.1 Distributive injustice: inequitable access and privacy concerns

Issues of distributive injustice center on two distinct areas: inequitable access to electric mobility (viewed as an elite or luxury item, especially for EVs) and concerns over privacy and cybersecurity.

By far the most frequently mentioned injustice attribute across the entire sample of interview statements was that access to electric mobility technologies are not distributed evenly across Nordic society. This point has already been made repeatedly in the literature, with examples from around the world. As Wells (2012: 751) writes, "only if an individual is wealthy enough to own or run an electric vehicle, or is afforded one by the company that employs them, can that individual then benefit." Thus studies of EVs in China (Tyfield et al. 2014; Tyfield 2014), France and Germany (Ensslen et al. 2015), Ireland (McCoy and Lyons), the United Kingdom (Skippon and Garwood 2011) and the United States (Neubauer et al. 2012) have all confirmed that adopters tend to be in higher income brackets, often using their EV as a second car. Similarly, early adoption patterns of EVs or e-bikes in Austria (Wolf and Seebauer 2014), Sweden (Vassileva and Campillo 2017), Canada (Axsen et al. 2016), and Norway (Nilsson and Nykvist 2016) have favored higher income users. At a more general level, transportation infrastructure and technology developments focusing on passenger cars (including EVs) often benefit middle and upper class denizens because: they cater to their transportation needs (the development of suburban highways, for instance); pollution and congestion often concentrate in poorer neighborhoods; and poor residents are more likely to be displaced or have their neighborhoods disrupted due to developments (Rose 2004; Kaufmann and Jamelin 2003).

As expected, the issue of equity and access did come up repeatedly from our interviews, although focused mostly on passenger EVs, and then a specific brand (Tesla). As R140 put it succinctly:

> *The most common EV in the Nordic Region is a Tesla. That's only for rich people and companies. It is not a mainstream car, it is not for everyone. It is a beautiful car, cool to have. But almost nobody can afford to.*

R192 was more elaborate in their reflection and highlighted the equity and justice challenge with electric mobility:

> *Tesla owners in Norway on average have a quite high income. The Tesla is not their only car, they can have it as maybe their second or third or fourth or fifth car. It's the wealthy getting in front of the common people so they can just pass them in the queue in the morning, and that's irritating … A recent newspaper found that the typical, single Tesla Model X owner received subsidies in 2016 worth the same amount you can hand out to provide 30,000 trips on the buses and the subway system of Oslo.*

If accurate, such a statement even quantifies the equity issues, placing a single EV adopter above the needs of thousands of public transport users—it privileges one "wealthy" person over 30,000 potential "common people."

That said, we should emphasize at this point that our interviewees are speaking about their perceptions, not necessarily mirroring factual diffusion patterns in the Nordic region. For instance, while it may be the most visible brand of EVs, Tesla continues to be outsold by Renault, BMW, Mitsubishi, and Nissan across Europe, and by VW and Nissan in the Nordic region, as Table 6 indicates. And, although they are not reflected in prominent sales patterns, a host of EVs are marketed for the "average consumer" and much more affordable than a Tesla, a trend initially started with the Buddy and Th!nk City. As such, the equity and access issues mentioned by respondents do not necessarily hold true across all contexts.

Table 6: Leading European and Nordic Electric Vehicle Brands

a. *Top Ten European Electric Vehicle Sales by Make and Model, 2017*

No	Brand	Volume of annual sales	EV Market Share
1	Renault Zoe	31,410	10%
2	BMW i3	20,855	7%
3	Mitsubishi Outlander PHEV	19,189	6%
4	Nissan Leaf	17,454	6%
5	Tesla Model S	15,553	5%
6	Volkswagen Passat GTE	13,599	4%
7	Volkswagen e-Golf	12,895	4%
8	Tesla Model X	12,630	4%
9	Mercedes GLC350e	11,249	4%
10	BMW 225xe	10,805	4%

b. *Top Nordic Electric Vehicle Brands, 2017*

	Denmark	Finland	Iceland	Sweden	Norway	Grand Total
VW	528	37	222	1086	24877	26750
Nissan	1500	367	1024	3635	18110	24636
Tesla	3503	511	27	3195	16066	23302

BMW	820	35	26	432	11448	12761
Renault	1256	32	55	1393	5590	8326
Mercedes	0	0	14	77	4348	4439
Hyundai	9	34	15	0	1660	1718
Opel	0	0	0	0	834	834
Kia	29	6	106	129	0	270

Source: Authors, top panel is modified from European sales data present in Zach (2018), bottom panel comes from the EAFO database (2018).

A second concern, however, touches not on the equity dimension to distributive justice, but on the unfairly distributed burdens and costs to society. These themes notably connect to loss of privacy, or the enhanced risk of cybersecurity breaches or terrorism. R59 captured the thrust of this vision by noting that the linking of ICT and vehicles enabled by a V2G transition could completely transform how people are connected to the web:

> *I imagine a world where companies can monitor and track your every move. Everyone could see where you are and stuff like that. If you're a one-person household people could see that the car is away. They could come into your house, it's a problem.*

Their statement implies that V2G could opens up intimately private lives not only to companies but to others who could use or misuse the system as mass surveillance. R64 emphasized such a system could have major distributive burdens such as terrorism:

> *Tomorrow's terrorism is probably completely different form yesterday's, and we need to think about that when we working with these systems … Would it be possible to get into these computers and make V2G cars do things they shouldn't do? … How will cyber security be protected or maintained in a world full of future terrorists and hackers? … Such a system may give many the opportunity to do the evil things.*

In short, these two statements reveal a fearful, potentially dark side to electric mobility adoption where the digital society that results may be more efficient, but also opens up new concerns about data protection and security.

4.2 Procedural injustice: exclusion and elitism in planning and policymaking

In the domain of procedural justice, respondents raised concerns that EVs only created (or were backed by) exclusionary policies and reflected elitism in national planning and policymaking. Essentially, these comments draw on or connect with some of the distributive justice issues mentioned above, such as equity, but relate it back to procedures and the regulatory process. In this way, issues of unfair access and elitism become reflected and entrenched in policy, which then further perpetuate inequity across mobility systems (Verlinghieri and Venturini 2018). Watson (2013) analogously shows how practices of mobility that depend on private cars can influence policy and regulations in ways that create "sticky points" resistant to change as well as "feedback effects" that marginalize other forms of mobility, such as cycling.

Again, similar to distributive justice, most statements about procedural justice centered on EVs rather than V2G or e-bikes more broadly. For instance, R86 suggested that:

> *In the beginning, I thought the negative reactions to Teslas was related to envy or jealousy. But after thinking more about it, it's a rational and emotional reaction. Why should we lose a lot of money for rich people getting a cheap, expensive, luxury car? The politicians … are [being] controlled.*

R87 framed this as a procedural justice issue about policy, rather than one purely of distributive justice:

> *People see EVs as only for the upper class. They find them very unfair. To the politicians, electric mobility sounds very good and they remain convinced that EVs can help store energy, decarbonize transport, and balance the grid.*

Similarly, R165 and R166 discussed that:

> *In Finland, government policy for EVs has been socially catastrophic, because only rich people buy new Teslas (laughs).*

R106 mentioned the problem as one of "*politicians prioritizing between hundreds of goals*," and perhaps lacking the "*political will*" to make controversial decisions or challenge entrenched interest. R202 advanced a similar concern when they noted that:

> *Almost everyone is okay with subsidizing the small ugly EVs that have a range of sixty kilometers. It [existing policy] subsidizes rich lawyers and bankers living in big houses now owning a 2.5 ton super luxury sports car which can drive circles around any Porsche. All of a sudden Tesla owners get hundreds of thousands of kroner in subsidies, and people with more practical, or uglier cars, get almost nothing.*

These statements all problematize how distributive issues such as access and affordability have become embedded in policy and the policymaking process.

At another level, respondents mentioned that the widespread adoption of electric mobility systems, especially in a V2G configuration, could potentially erode democratic processes, and undermine people's autonomy or liberty. R188 for example noticed a reluctance among consumers to "*become dependent on some distant infrastructure for their daily travel.*" R30 illustrated another part of the logic of this vision when noting *"people are afraid that the batteries will not last long enough and it is very costly to get new ones."* This last statement underscores the potential for a V2G system to become more easily controlled by profiteering companies—creating an exclusionary innovation system or policy regime.

4.3 Cosmopolitan injustice: externalities and environmental impacts

The cosmopolitan justice issues connected to electric mobility largely touch on externalities—at various types (environmental, community, social) and scales (local, national, global).

In the environmental domain, some literature has noted that EVs in particular can lead to externalities such as greenhouse gas emissions from electricity use, toxic pollution from battery manufacturing and disposal, and water consumption. In terms of climate change, for EVs to actually deliver well-to-wheels carbon reductions, the carbon content of electric power generation must be low. Otherwise, EVs will simply shift the exposure to air pollution away from urban areas and toward rural populations located closer to the power plants that provide electricity for recharging EV batteries in the city, as was found to be the case in China (Ji et al. 2012). Any overall GHG reduction benefit will depend on the carbon intensity of the electricity used during the battery recharging periods.

R199 offered an illustrative statement underscoring environmental concerns in the context of plug-in hybrid EVs. They noted:

> *The problem with plug-in hybrid EVs in the region is that they can switch between fossil fuels (gasoline or diesel) and all electric mode. Many of such cars are bought by rich people not bothering to plug it in, driving it in pure fossil mode all the time only to save 100,000 to 200,000 kroner in taxes. They buy the car but never intend to*

> *use the environmental package, so that's obvious that you need some scheme to stimulate the real zero emission driving.*

And in terms of e-bikes, both Wolf and Seebauer (2014) and Lin et al. (2017) have noted (in non-Nordic countries) that such technologies do not largely displace or substitute for more carbon intensive forms of travel or commuting patterns (such as public transit).

In addition, some research has suggested that EVs shift pollution from local places and make it more regional; it also depends on local fuel mixes whether a net benefit to health or greenhouse gas emissions occur. For instance, Buekers et al. (2014) found that EV benefits occurred only in countries that relied on low air pollutant emitting fuel mixes, i.e., small countries in the European Union. There, such benefits accrue mostly in urban centers. But this merely shifts pollution flows outward to other countries and close to power plants, mostly in rural areas, and perhaps across national borders, making it a cosmopolitan issue. Consequently, there is a potential for richer urbanites to capture substantial benefits, while passing all the burden into the lungs of others.

Furthermore, the production of EVs requires equipment and material inputs that raise concerns about toxicity and recycling. Electric drivetrains, motors, and batteries need lithium, nickel, copper, and aluminum, as well as critical materials, somewhat harder to find, such as, cobalt, and indium. For instance, a typical hybrid electric vehicle such as the Toyota *Prius* needs 2.2 pounds (0.5 kilograms) of neodymium, in addition to substantial amounts of rare earth minerals such as dysprosium, neodymium, and praseodymium as well as lithium (Hensel 2012). R21 made this connection when they stated that

> *As far as I know, most of the material for batteries, especially lithium, comes from Bolivia or Columbia. Is it really better to be dependent on Bolivia and Columbia on lithium than Saudi Arabia on oil? So what is the difference? Whether it's a lithium mine in the desert of Bolivia, or an oil well in Riyadh, you have to destroy many things to get either one.*

In this context, the possible environmental benefits of an electric mobility transition—fewer greenhouse gas emissions and improved air quality in urban environments—may come at the cost of greater pollution from factories making components and the landfills and junkyards where obsolete models end up (Hawkins et al. 2012), especially when compared to low-carbon public transport. A related concern is how the diffusion of electric mobility across the Nordic region may push conventional, dirtier used cars to other markets—especially when Nordic used cars are already being exported to countries with more relaxed environmental standards such as the developing economies of the Asia-Pacific or Sub-Saharan Africa (United Nations Environment Program and United Nations Economic Commission for Europe 2017).

A third environmental externality is water. A shift from internal combustion engines to electric power for mobility is likely to increase consumption of electricity, and thus contribute to water scarcity. Looking at the United States, King and Webber (2008) projected that the increased water cooling of thermoelectric power plants providing energy to EVs could increase aggregate water consumption by a multitude of 3 and water withdrawals by a multitude of 17. This sheer water intensity of EVs makes it difficult to electrify transport where water is scarce—something that matters given projections of water stress. R45 discussed this concern in terms of "*heat waves across Europe*" that could result in *"power outages across the region*," expressing worry it could be "*too hot*" to generate electricity for EVs. Most of the world's water sources are already under stress, with one assessment calculating that global groundwater needs are 3.5 times in excess of the actual area of aquifers, and warning that 1.7 billion people live in areas "where groundwater resources and/or groundwater-dependent ecosystems are under threat" (Gleeson et al. 2012)

An additional cosmopolitan justice issue falls in the community domain, where externalities to greater electric mobility adoption include a greater risk of accidents and traffic congestion, given that vehicles and e-bikes can still promote an automobility paradigm that transportation should be private, rather than public, and motorized rather than human-powered (Sovacool and Axsen 2018). High volumes of EVs can still contribute to traffic jams that make reaching even nearby destinations time consuming, and can reduce access to community services, employment opportunities, and social support networks. As R55 indicated:

> *When they aren't in bus lanes or special parking garages, EVs still don't save you time compared to rapid transit or the metro. They still get stuck in congestion [traffic jams].*

R67 added, "*for sure, congestion is a problem*." More seriously, EVs and e-bikes are prone to life-endangering accidents every year. The World Health Organization (2018) estimates that every year 1.25 million people are killed and 20 to 50 million injured in traffic road crashes involving cars or motorcycles; globally, road traffic injuries are also the leading cause of death for those between the age of 15 and 29 years old.

Finally, in the social domain, motorized vehicles (of both the electric and internal combustion type) require less physical activity than walking or cycling, or even than mass transit, which usually involve a walking component. R204 expanded this argument when noting:

> *The reason I don't want an EV is because I like to cycle and walk. I don't get the same level of exercise if I were to switch over.*

EVs and e-bikes thus contribute to public health problems. Physical inactivity is responsible for 3.3% of worldwide deaths and 19 million disability adjusted life years annually, and those that rely on private transport have higher rates of diabetes, cardiovascular disease, and obesity than those that walk or take public transport (Woodcock et al. 2007). To the extent that electric mobility diffusion trades off with walking, cycling, or public buses and trains (which often require walking), the overall public health effects of electric mobility could be negative. Under this lens, EVs reflect a potential half-measure that fails to capture many of the additional benefits of public transportation.

4.4 Recognition: jobs, vulnerable groups, and gender

This class of justice concerns relate to recognition justice and vulnerability, especially jobs (notably small and independent fuel providers and maintenance firms), impacts on rural residents, and the entrenchment of patriarchy (or at least objectification of women).

First, a global electric mobility transition has the potential to significantly disrupt both global energy and automotive markets. In laying out his vision for electric mobility, the entrepreneur Shai Agassi (2007) noted in a white paper that:

> *The total economic dislocation [by electric mobility] seems almost incomprehensible. Fuel at the pump represents a market of $1.5 trillion every year. Cars and components size roughly to the same size of market, $1.5 trillion a year. Financing for new cars, gaining acceptance worldwide is estimated at $0.5 trillion a year. Clean electricity generation for cars is a market that will reach $0.15 trillion a year. ERG infrastructure construction will reach levels of $0.5 trillion a year. Battery manufacturing will reach similar levels of $0.5 trillion a year, accounting for reduction in battery cost as the market size will continue to increase. In-car services, such as GPS, media, phone as well as related services such as insurance and maintenance collectively worth more than $1.5 trillion a year will be affected. Carbon credits alone will be worth roughly $0.3 trillion when all cars are driven on clean electricity. In the aggregate, we are looking at an annual dislocation reaching roughly $6 trillion a year.*

Admittedly, much of these impacts will fall upon major incumbents such as ExxonMobil and British Petroleum (oil and fuel suppliers) and OEMs such as Volkswagen or Nissan—hardly a vulnerable population in a traditional justice sense. But they could result in greater levels of unemployment and the closure of factories that can collapse communities (e.g., Detroit) and lead to the next generation of vulnerable groups.

Furthermore, in the Nordic region many petrol and fuel stations would need to install electric charging infrastructure, a costly prohibitive endeavor. Volkswagen, Daimler, BMW and Ford already announced together than they expected the costs for building the first wave of 400 "fast charging stations" for EVs in Europe to surpass €1 billion (Campbell 2016).

Automotive dealerships and maintenance firms would also see a potentially large loss of revenue, as well as those selling alternatives to electric vehicles such as small-scale biofuel or hydrogen companies, a growing industrial segment at least in Denmark (Andreasen et al. 2014a; 2014b). McKinsey & Company (2017) estimate that the automotive maintenance and repair business generates about 45% of total aftermarket revenues in Europe, with the remainder coming from retail and wholesale of vehicle parts, a $237 sector in 2015 (McKinsey & Company 2017). That said, the higher use of electronics and sensors in EVs can increase the cost of an average car crash (and repair), and facilitate new services becoming available in the form of diagnostics and car data digitalization, so not all repair revenue would be lost to EVs.

Nonetheless, within Nordic automotive dealerships specifically, Zarazua et al. (2018) found that salespersons generally articulate that EVs take a longer time to sell, take more effort to sell, and result in less revenue for maintenance—which can all result in negative impacts on profitability for automotive companies and dealerships, and consequently jobs, in the short term. Book et al. (2012) imply that independent automotive and maintenance firms could even be at a unique and comparative disadvantage, given that smaller independent shops are less able to cope with the required expertise and investments in infrastructure to handle EVs.

Multiple interview respondents reflected these concerns. R010 noted that:

> *EVs may be good for business in general, but they are not necessarily good for the car industry itself, there are big hurdles there. You have to understand how the business model of a company like Volkswagen works. They sell you a car, and then they have this massive distribution and support network that lives on and thrives on support, spare part sales and lubricating the car and changing this and that. They expect that you buy a new car and then you maintain your guarantee to come there every 3 or 6 months or whatever for checkups so they can charge you every time. But if you have an electric car and you don't ever have to come back, it's a massive change in the business model.*

R36 added that:

> *If you have an electric car, the margin is smaller today, because the cars are really expensive, and after a dealer sells the car, it's basically gone. There are few maintenance revenues because EVs are very reliable and there is a high likelihood there will no problems, especially since they have better drivetrains and transmissions.*

R114 confirmed this numerical:

> *Current EV fleets show that they save at least 80% on maintenance needs. Because there's nothing wrong with them. There's no oil change, no oil filter, no tail pipe. So that's a huge challenge in the industry to come. How are we going to make money when we have mainly EVs.*

R207 therefore concluded that:

> *The losers are the traditional energy firms who will be displaced by V2G and you will also have firms repairing traditional vehicles or owning gas stations that will suffer.*

Thus, it seems clear that EVs will disrupt and harm at least some businesses across the Nordic region and Europe.

More complicatedly, electric mobility adoption could alter both the provision of mobility services across urban and rural areas. As R181 warned that V2G may seem wonderful until one considers marginal and vulnerable segments of the population, such as those in rural areas:

> *Even though I'm a green person, I will have to accept that there are going to be diesel trucks taking food to the northern most corner of Finland because that is what makes sense. It [a transition to electrification] could be very discriminative to exactly the most marginalized or vulnerable elements of society. … I have a problem accepting such a system. That just because it makes more economic or environmental sense, that we marginalize people even more.*

This pattern could only concentrate the burdens of a V2G transition among some vulnerable groups.

A final recognition concern centers on gender roles and gender identity, or at least the possible entrenchment of masculinity or patriarchy and a degree of sexism. For R89 remarked that:

> *If electric vehicles have a very big advantage, it would be the "dick factor." If you want to go with a blonde you want a car with acceleration. And electric cars they have very good acceleration.*

This sort of statement begins to imbue a masculinity to particular EVs and also connect them to sexuality. R196 clarified this further:

> *Other than Tesla, which has some power and acceleration, most EVs are downright ugly. Most of the models I see here look like a fucking dustbin. It looks like a plastic can on wheels! Where is the dick factor on that one, you know? I mean, if you put your ass in a Buddy, you immediately look eighty years old. I'd be relegated to a sexless life for sure if I bought one, forget about it!*

Although such statements were not widely reflected across the sample of interviews, they do reveal the extent that EVs can become integrated with gender constructs and also particular gender roles that marginalize women and reduce them to sexual objects.

5. Conclusion and implications

To conclude, our qualitative examination of the distributive, procedural, cosmopolitan, and recognition injustice dimensions to electric mobility and V2G—derived primarily from semi-structured expert interviews—expands our lexicon of justice consequences and validates the necessity of considering them comprehensively, holistically, and multi-dimensionally. Our assessment reveals that experts question the underlying morality of promoting expensive, inequitable, luxury items as a way to provide mass mobility. Other experts criticize the elitism and exclusionary nature of EV planning and policymaking. Still others take issue with imposing the burden of electric mobility innovations on the environment (notably the climate, air pollution, water consumption, and the toxic impacts of rare earth minerals), communities, and public health systems, and/or the possible exacerbation of unemployment, rural poverty, or patriarchal gender roles, especially as compared to better alternatives, like public transportation. This demands that contemporary analysts, policymakers, and even consumers begin to reconsider their energy and mobility decisions as moral ones, and fairly complex ones at that—transcending normally separate dimensions of energy justice.

Furthermore, our qualitative mapping of injustices does lead to some forceful policy implications. EVs, as compared to conventional cars, are commonly framed as a remedy to the existing injustices of the current mobility system, espousing the potential energy justice benefits of electrification. On the other hand, we have shown above that EVs can pose injustices of their own in the broader mobility context. As such, if EVs are determined by policymakers to play an essential role in national climate change mitigation plans, we suggest several policies to prevent or at least minimize injustice in Table 7. Thus, our justice framework shows that policymakers need to think broadly when implementing EVs in order to avoid half-measures of energy justice.

Table 7. Policy mechanisms for energy justice, electric mobility, and V2G

Concept	Example(s)	Policy Response
Distributive justice	EVs only accessible by higher socioeconomic consumers	Avoid regressive EV subsidies, encourage lower-cost EV development, increase consumer knowledge of cheaper EVs
Procedural justice	EV policy determined in scope of higher socioeconomic consumers Exclusion of other subsets of population (low income, users of other mobility)	Better inclusion of entire population in EV policies (e.g. public charging infrastructure coverage), broader electrification of public transport, more comprehensive transport policy, progressive EV and V2G subsidies
Cosmopolitan justice	EVs exacerbate other externalities (congestion, electricity-related externalities) Global south excluded from EVs, instead get cheap petrol/diesel	Deployment of EVs requires deployment of other renewable electricity, transportation planning policies, internalizing externalities, carefully managing battery and lifecycle waste streams Shift international focus of EVs beyond global North, international mechanisms to shift technology and support small EV initiatives present in those countries (clean development mechanism policy)
Justice as recognition	Conventional car industry job loss, particularly maintenance	Implement job training programs for new EV industry (e.g. battery specialization, EVSE repair, V2G aggregation) similar to coal-to-solar transition

	Dealership resistance to selling new technologies	Consistent EV and V2G policy signals, allowing industry preparation and investment for EV transition

In addition, many of the injustices identified, or the issues of equity and vulnerability that arise, are not “new” to EVs or V2G—they likely exist with other low-carbon technologies and also conventional cars and other forms of mobility. However, a lesson here is perhaps that changing the performance or engine of a vehicle, or introducing a new type of car such as an EV or an innovation such as V2G, does not necessarily change the underlying political economy or power dynamics behind mobility or automobility. Systems of mobility themselves—involving multiple, competing and overlapping technologies, modes of mobility, and transport infrastructures—can also be just or unjust, even if they utilize innovations such as EVs or V2G that have material potential to reduce environmental and social harms. There may be situations, practices, or socio-material configurations where V2G EVs meet principles of justice, sustainability, or sustainable development, but also areas where they may not (such as when an EV reinforces automobility and merely represents an additional car, and thus becomes a net environmental burden, or increases the demand for motorized mobility at the expense of more active walking and cycling). The justice potential of electric mobility is therefore situational, relational, and contingent. The answer to the question “Is it good?” will invariably be “It depends.”

As a final reflection, energy injustices generally also do not exist in black or white – the energy justice concerns for EVs and V2G transcend different domains including distribution of benefits and burdens, planning procedures and due process, global whole-systems issues such as the flow of negative externalities, and aggravated consequences on marginalized social groups. One can only grapple with these complexities with a holistic energy justice framework. Moreover, within this “political economy” of justice (Jenkins et al. 2016), interventions such as EVs and V2G mobility—rightly lauded for their prospective environmental and even economic attributes— can still exacerbate inequality, even when they offer net societal benefits. Further research is needed to properly assess the justice aspects of EVs, for instance by integrating or juxtaposing a justice perspective with the vast studies on the positive co-benefits of EVs, offering a more balanced, rounded out perspective. Nevertheless, the above reminds us that even potentially just low carbon forms of mobility such as EVs or V2G, which can be net beneficial for society, still have the potential to concentrate environmental hazards among the socially vulnerable and geographically disadvantaged.

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